Amendments to the Specification

The paragraph starting at page 1, line 10 and ending at page 2, line 2 has been amended as follows.

For the ink jet recording apparatus, in the case that the apparatus is not used for a long period or in the case that a specific ejection port among many ejection ports rarely ejects the ink compared with other ejection ports even if the apparatus is used, ~~by~~ due to vaporization of moisture in the ejection port or an ink chamber communicated with the ejection port, viscosity of the ink is increased or the ink is fixed to the ejection port and, as a result, sometimes ejection failure occurs. When an ink droplet, a water droplet, dust, or the like adheres to ~~a~~ an ejection port surface of a recording head on which the ejection ports are provided, the ejected ink droplet is pulled by the adhesion material. As a result, sometimes an ejecting direction is deflected. In order to eliminate these problems, an ejecting recovery device (cleaning mechanism portion) including the following recovery processing means for maintaining and recovering ink ejecting performance of the recording head is provided in the ink jet recording apparatus.

The paragraph starting at page 4, line 12 and ending at line 25 has been amended as follows.

That is to say, in the technique disclosed in Japanese Patent Application Laid-Open No. 07-108684, a control cam playing the role of the lifting means for freely

lifting the capping portion forward and backward is placed immediately under the cap supporting portion. Therefore, though the close contact to and separation from the ejection port surface can be easily carried out, a minimum space for a size of the control cam and a stroke necessary for vertical movement of the cap supporting portion is required ~~to~~ for the capping mechanism. As a result, a height of the ejecting recovery device itself is increased and miniaturization of the recording apparatus cannot be realized.

The paragraph starting at page 5, line 15 and ending at line 21 has been amended as follows.

It is an object of the present invention to provide ~~the~~ an ink jet recording apparatus, in which the structure is compact and inexpensive, the cap member can be surely held in close contact with the ejection port surface of the recording means with ~~constantly~~ a constant pressing force, and the ejection port surface can be covered while ~~the~~ airtightness is surely ~~held~~ maintained.

The paragraph starting at page 6, line 10 and ending at line 17 has been amended as follows.

Further, the present invention aims at ~~the~~ an ink jet recording apparatus including ~~the~~ a capping mechanism, in which the structure is compact and inexpensive, the cap member can be surely held in close contact with the ejection port surface of the

recording means with ~~constantly~~ a constant pressing force, and the ejection port surface can be covered while ~~the~~ airtightness is surely ~~held, is provided~~ maintained.

The paragraph starting at page 9, line 13 and ending at line 27 has been amended as follows.

In Figs. 1 to 3, an ink jet recording apparatus 1 includes a carriage motor ~~which is~~ as a driving source (not shown), a carriage 2 which is equipped with a recording head as the recording means, and a driving mechanism 4 which reciprocates the carriage 2 in a direction of ~~an~~ the two-headed arrow ~~with both heads~~ A with the carriage motor. The ink jet recording apparatus 1 also includes a paper feeding mechanism 5 which feeds recording paper P as the recording medium to a recording portion, a conveying mechanism having a conveying roller 14 for conveying the fed recording medium P through the recording portion and the like, and an ejecting recovery device 10 (cleaning mechanism portion) which maintains and recovers the ink ejecting performance of the recording head.

The paragraph starting at page 11, line 6 and ending at page 12, line 3 has been amended as follows.

Fig. 15 is the partial perspective view schematically showing the structure of the ink ejecting portion of the recording means (recording head 3). In Fig. 15, a plurality of ejection ports 82 are formed with a predetermined pitch in ~~a~~ an ejection port surface 81

facing the recording medium P (for example, recording paper) with the ejection port surface 81 having a predetermined gap (for example, in the range of about 0.2 mm to about 2.0 mm) from the recording medium P, and an electrothermal converter 85 (for example, electric heating element) which generates the energy for ejecting the ink is provided along a wall surface of each channel 84 which communicates a common liquid chamber 83 with each ejection port 82. The recording head 3 is attached to the carriage 2 so that the ejection ports 82 are arranged in the direction intersecting a main scanning direction (the direction of the arrow A). Thus, the recording means 3 (recording head) is formed such that the corresponding electrothermal converter 85 is driven ~~(energization)~~ (energized) on the basis of an image signal or an ejecting signal, the ink in the channel 84 is heated to ~~the~~ film boiling, and ~~the~~ an ink droplet is ejected from the ejection port 82 by the pressure generated at that time.

The paragraph starting at page 13, line 11 and ending at page 14, line 19 has been amended as follows.

In the ink jet recording apparatus 1, an ejecting recovery device 10 which maintains and recovers the ink ejecting performance of the recording head 3 to the normal condition is provided at the desired position within the moving range but out of the recording area. In Figs. 1 to 3, the ejecting recovery device 10 includes a capping mechanism 11 which is in close contact with the ejection port surface 81 of the recording head 3 to make the ejection port airtight (capping), wiping means 12 for wiping the

ejection port surface 81 of the recording head 3 to clean the ejection port surface 81, and suction means 48 ~~for~~ having a suction pump for ~~giving~~ applying the suction force of the negative pressure at the ejection port through the capping mechanism 11 while the recording head is capped. Suction recovery means for sucking and removing ~~the~~ ink having increased viscosity or ~~the bubble~~ bubbles in the ejection port can be formed by operating the suction means 48 to suck the ink from the ejection port 82 with the recording head 3 capped. Protection of the recording head 3 can be obtained and drying of the ink can be prevented (suppressed) by capping the ejection port surface 81 with the capping mechanism 11 during non-recording such as during storage of the recording apparatus or during standby. Further, the wiping means eliminates deflection of an ink ejecting direction or ejection failure in such a manner that the wiper rubs against the ejection port surface 81 of the recording head 3 to wipe and remove ~~a~~ foreign matter such as ~~the~~ ink ~~droplet~~ droplets adhering to the ejection port surface 81, ~~the~~ ink fixed to the ejection port surface 81, and dust. The capping mechanism 11, the wiping means 12, and the suction means 48 can maintain the ink ejecting performance of the recording head 3 ~~at~~ in the normal state.

The paragraph starting at page 14, line 20 and ending at page 15, line 6 has been amended as follows.

In Figs. 1 to 3, the suction means 48 includes a tube pump which generates the negative pressure in a suction tube 32 arranged along an arc-shaped inner surface of a

recovery base 20 (a base portion of the ejection recovery device) as a guide surface, in such a manner that ~~the~~ a suction tube 32 (pump tube) is pressed and squeezed by a pressing roller 33 rotatably supported by a pressing roller holder 31 in which rotational drive is carried out about a concentric axis. In the example shown in the figure, ~~the~~ two suction tubes 32 are used, and the two suction tubes 32 ~~is~~ are supported by a tube guide 53 so as to be positioned along the arc-shaped guide surface.

The paragraph starting at page 15, line 7 and ending at page 16, line 6 has been amended as follows.

In the embodiment, each pressing roller 33 is rotatably supported in a rectangular guide hole formed in the pressing roller holder 31 and pressed by a pressing spring (not shown). Each pressing roller 33 performs pump action in such a manner that the rotational drive in one direction of the pressing roller holder 31 presses and squeezes the suction tube 32. Further, each pressing roller 33 acts so as to release the suction tube 32 to communicate with an atmosphere in the rotational ~~dive~~ drive in the reverse direction of the pressing roller holder 31. The arc-shaped guide surface (guide portion) of the recovery base 20 is formed in the form of a circle, and the two pressing rollers 33 per one suction tube 32 are arranged so that each of the two pressing rollers 33 is located with a difference in rotational angle of about 180°. Accordingly, while one of the pressing rollers 33 retreats, the other pressing roller 33 starts the pressing, so that the suction action can be continuously performed. In the case that the guide surface of the recovery base 20 is

substantially formed in the form of the circle, only one pressing roller can perform the same continuous suction action. Further, even in the case that the guide surface (guide portion) is a semi-circle, at least two pressing rollers 33 can ~~be~~ perform the same continuous suction action.

The paragraph starting at page 18, line 16 and ending at page 19, line 6 has been amended as follows.

The capping mechanism 11 also includes two atmosphere communicating tubes 45 which are respectively connected to the interior of each ~~inside~~ of two cap chambers provided in the cap 35 and atmosphere communicating valves 46a and 46b provided at the other ends of each of the atmosphere communicating tubes 45. These atmosphere communicating valves 46a and 46b include an on-off (open/close) valve switching each compartment (cap chamber) of the cap 35 between the closed condition and open condition. The two suction tubes 32 communicated to the suction means 48 are connected to a joint portion provided in the cap holder 36 so that action of the suction means 48 ~~gives~~ applies the negative pressure in the cap 35 while the cap 35 abuts on the ejection port surface 81 and the suction action caused by the negative pressure allows the suction of the ink from the ejection port 82 of the recording head 3.

The paragraph starting at page 20, line 18 and ending at page 21, line 5 has been amended as follows.

The cam 38 is formed to control not only the capping action but also the wiping action of the wiping means 12 and the lifting action of a CR lock lever 29 (Fig. 2). The CR lock lever (carriage lock lever) 29 forms positioning means for controlling a relative position between the recording head 3 and the capping mechanism 11 during the recovery action of the recording head 3. The control of each action of the above-described means such as the capping mechanism 11, the wiping means 12, the suction means 48, and the CR lock lever 29 is executed in such a manner that a flag for a cam position detecting sensor, ~~Provided~~ provided in the cam 38, and a cam position detecting sensor 40 control the positioning of the rotational position of the cam.

The paragraph starting at page 23, line 3 and ending at line 20 has been amended as follows.

As shown in Figs. 8 and 9, according to the positional relationship between the cap base rotating support shaft 34a and the cam acting boss 39 of the cap base 34 and the positional relationship of the cam 38 in the capping mechanism 11 of the embodiment, a distance (L1) from the cap base rotating support shaft 34a to the cap rib 41 is longer than a distance (L2) from the cap base rotating support shaft 34a to the cam acting boss 39. Therefore, in order to move the cap 35 by a retracting stroke (S), an outer diameter (T2) of the cam 38 can be decreased in proportion to L2/L1, as compared to the outer diameter necessary to the case of the structure in which the cam 38 is located directly under the cap 35 as shown in Figs. 10A and 10B. As the distance (L2) is decreased as ~~less~~ much as

possible and the distance (L1) is increased as much as possible, the outer diameter (T2) can be decreased significantly.

The paragraph starting at page 23, line 21 and ending at page 24, line 11 has been amended as follows.

On the other hand, in the capping mechanism, shown in Figs. 10A and 10B, to which the present invention ~~shown in Fig. 10~~ is not applied, since the cam 38 is provided directly under the cap 35, in order to move the cap 35 by the same distance as the retracting stroke (S) in Fig. 9 relative to the recording head 3, it is necessary that an outer diameter (T4) of the cam 38 is set to a value according to an absolute value of the retracting stroke (S) and it is necessary that the outer diameter (T4) of the cam 38 is formed to be much larger than the outer diameter (T2) in Fig. 8. In other words, the relationship between T2 and T4 approximately has the difference of a ratio of L2 to L1 shown in Fig. ~~8 or so~~ 8. In the structure of the embodiment shown in Figs. 7 to 9 and 12, the size of the cam 38 is decreased and the height of the capping mechanism 11 is decreased, so that the miniaturization of the capping mechanism can be realized.

The paragraph starting at page 26, line 18 and ending at line 26 has been amended as follows.

It is preferable that the gap Z (Fig. 7) between the ejection port surface 81 of the recording means 3 and the cap 35 in the embodiment is set to ~~the~~ a distance such that ~~a~~ ~~bounce~~ splashing of the ink from the cap 35 to the ejection port surface 81 is reduced during the pre-ejection and ~~flotage~~ floating of ink mist, generated during the pre-ejection, in the main body of the apparatus is reduced. The gap Z is selected to be about 2.5 mm in the embodiment.

The paragraph starting at page 28, line 3 and ending at line 17 has been amended as follows.

Therefore, in the abutting action of the cap 35 on the ejection port surface 81, the rotational movement of the cap 35 is generated by using, as a fulcrum, the region (edge rib) Q, where the cap rib 41 initially abuts on the ejection port surface 81, so that relative shift between the cap rib 41 and the ejection port surface 81 ~~is~~ never ~~generated~~ occurs during the time from the abutment of the plane of the cap rib 41 (cap sealing plane) on the ejection port surface 81 at the abutting start region Q to the completely close contact of the whole plane of the cap rib 41 to the ejection port surface 81. As a result, the cap 35 can be gradually pressed to the ejection port surface 81 in ~~the~~ a stable state and ~~the stably~~ a stable capping action can be realized.

The paragraph starting at page 28, line 26 and ending at page 29, line 15 has been amended as follows.

In the second embodiment shown in Figs. 13, 14A and 14B, a cap holder attitude controlling hole 62 is provided in the substantial center portion of the cap base 34 and a cap holder attitude controlling pawl 61 extending downward from the cap holder 36 is fitted into the cap holder attitude controlling hole 62 by way of the structure for controlling the attitude of the cap holder 36 to the cap base 34. Similarly to the first embodiment, the second embodiment has the structure which allows the cap holder 36 to obliquely control at a predetermined amount (predetermined angle) relative to cap base 34. Though the second embodiment shown in Figs. 13, 14A, and 14B differs from the first embodiment in the above-described points, the second embodiment substantially has the same structure ~~for~~ as the first embodiment in other points.

The paragraph starting at page 29, line 16 and ending at line 26 has been amended as follows.

According to the embodiment having the above-described structure, the capping mechanism 11 ~~in which the structure~~ is compact and inexpensive, the cap member 35 can be surely held in close contact with the ejection port surface 81 of the recording means (recording head) 3 with ~~constantly~~ a constant and ~~equally~~ equal pressing force, and the ejection port surface 81 can be covered while ~~the airtightness is surely held~~ surely maintaining airtightness, and ~~the~~ an ink jet recording apparatus which utilizes the recovery device 10 having the capping mechanism 11 ~~are~~ can be obtained.

The paragraph starting at page 30, line 8 and ending at line 17 has been amended as follows.

The ink jet recording apparatus having a serial recording ~~method~~ operation in which the recording means 3 is ~~relatively~~ moved relatively to the recording medium P has been described as the example. However, the invention can be also applied to the ink jet recording apparatus having a line recording ~~method~~ operation in which the recording is carried out only with a sub-scan by using a line head type of recording means having a length covering a whole width or a part of the width of the recording medium P, and the same ~~effect~~ effects can be achieved.

The paragraph starting at page 30, line 18 and ending at page 31, line 1 has been amended as follows.

The invention can be also applied to ~~the~~ a recording apparatus having one recording means, ~~the~~ a color recording apparatus which utilizes ~~the~~ a plurality of recording means carrying out the recording with ~~the~~ a plurality of color inks, ~~the~~ a gray-scale recording apparatus which utilizes ~~the~~ a plurality of recording means carrying out the recording in the same color with ~~the~~ different densities, or ~~the~~ a recording apparatus combining those recording apparatuses, and the same ~~effect~~ effects can be achieved.

The paragraph starting at page 31, line 11 and ending at line 21 has been amended as follows.

The invention can be also applied to the case in which the ink jet recording apparatus uses ~~the~~ recording means ~~for~~ utilizing, for example, an electro-mechanical converter such as a piezoelectric element. However, particularly the invention can obtain ~~the~~ excellent ~~effect~~ effects for the ink jet recording apparatus using the recording means ~~having the method~~ in which the ink is ejected by utilizing ~~the~~ thermal energy. This is because the method utilizing ~~the~~ thermal energy can achieve ~~the~~ high-density recording and ~~the~~ fine recording.